

# Mechanical Engineering Department Seminar

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1130 Mechanical Engineering

111 Church Street SE, Minneapolis, MN 55455

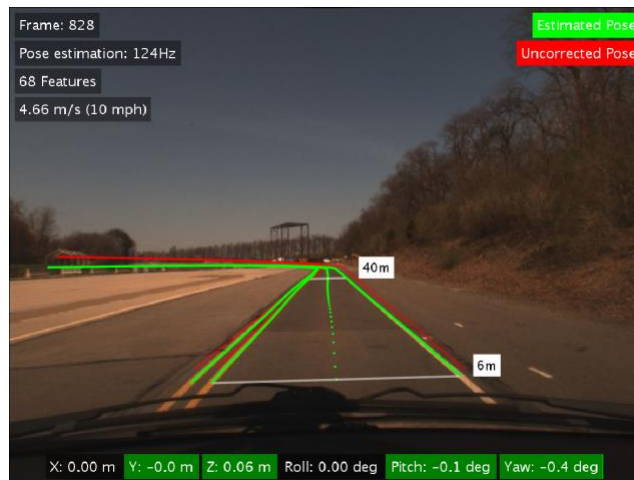
## The Application Lessons of Using Models-On-Maps Algorithms: Or Why MoMs know best

Sean Brennan



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Automated and autonomous systems – particularly in the domain of ground vehicles – have historically exploited a-priori knowledge of the operational environment to improve control system performance. For ground vehicles, this task-specific location-based compression of information is generally called a “map.” And like a wandering hiker on a trail, vehicles use maps in a feedback-loop fashion: the current model-based estimate of position hints at what features within a map are contextually relevant, and the map’s features are used to update the current estimate of position, usually within the context of a model of the ego-motion. But because ego-motion is most often map-directed, there is an interplay of at least two feedback loops – one involving the time-dynamics of the plant, and the other involving the spatial-dynamics of map access. Through a series of application examples, this talk discusses the algorithmic, deployment, and educational challenges of using Models-on-Maps (MoMs) algorithms for control and/or estimation related to ground vehicle motion.



**Bio:** Dr. Sean Brennan is a Professor of Mechanical Engineering at Penn State University where he has taught since 2003. He leads the Intelligent Vehicles and Systems Group, consisting of roughly 20 to 30 engineers in research focused on vehicle dynamics and automation both at high speeds such as highway vehicles and high-speed off-road maneuvering, and low speeds such as bomb-disposal robotics, automated wheelchair systems, and nuclear inspection robotics. His diverse research applications are unified by a focus on model-based control and estimation algorithms that utilize location-specific information compression – i.e. Models on Map algorithms. The deployment of MoMs typically include V2V and V2I systems, driving simulators, and even teleoperation. Prof. Brennan currently leads Penn State’s vehicle activity at the Larson Transportation Institute test track, one of the ten USDOT-designated Autonomous Vehicle Proving Grounds. His research has resulted in approximately 150 peer-reviewed publications to date.